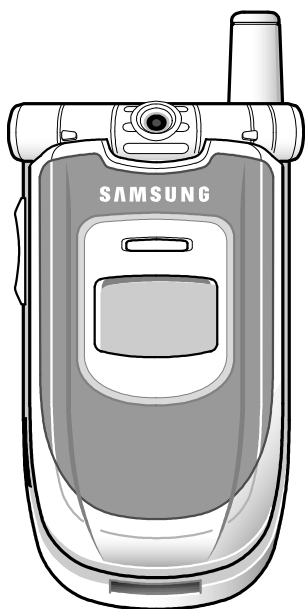


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GSM TELEPHONE  
SGH-P100

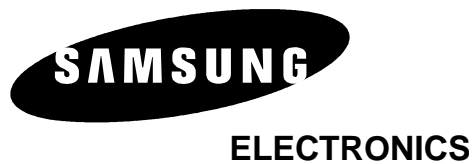
# ***SERVICE*** *Manual*

GSM TELEPHONE



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Samsung Electronics Co.,Ltd. August. 2003  
Printed in Korea.

Code No.: GH68-03791A  
BASIC.

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# 1. SGH-P100 Specification

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## 1. GSM General Specification

	GSM900 Phase 1	EGSM 900 Phase 2	DCS1800 Phase 1	PCS1900
Freq. Band[MHz] Uplink/Downlink	890~915 935~960	880~915 925~960	1710~1785 1805~1880	1850~1910 1930~1990
ARFCN range	1~124	0~124 & 975~1023	512~885	512~810
Tx/Rx spacing	45MHz	45MHz	95MHz	80MHz
Mod. Bit rate/ Bit Period	270.833kbps 3.692us	270.833kbps 3.692us	270.833kbps 3.692us	270.833kbps 3.692us
Time Slot Period/Frame Period	576.9us 4.615ms	576.9us 4.615ms	576.9us 4.615ms	576.9us 4.615ms
Modulation	0.3GMSK	0.3GMSK	0.3GMSK	0.3GMSK
MS Power	33dBm~13dBm	33dBm~5dBm	30dBm~0dBm	30dBm~0dBm
Power Class	5pcl ~ 15pcl	5pcl ~ 19pcl	0pcl ~ 15pcl	0pcl ~ 15pcl
Sensitivity	-102dBm	-102dBm	-100dBm	-100dBm
TDMA Mux	8	8	8	8
Cell Radius	35Km	35Km	2Km	-

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## 2. GSM TX power class

<b>TX Power control level</b>	<b>GSM900</b>	<b>TX Power control level</b>	<b>DCS1800</b>	<b>TX Power control level</b>	<b>PCS1900</b>
5	33 ±2 dBm	0	30 ±2 dBm	0	30 ±2 dBm
6	31 ±2 dBm	1	28 ±3 dBm	1	28 ±3 dBm
7	29 ±2 dBm	2	26 ±3 dBm	2	26 ±3 dBm
8	27 ±2 dBm	3	24 ±3 dBm	3	24 ±3 dBm
9	25 ±2 dBm	4	22 ±3 dBm	4	22 ±3 dBm
10	23 ±2 dBm	5	20 ±3 dBm	5	20 ±3 dBm
11	21 ±2 dBm	6	18 ±3 dBm	6	18 ±3 dBm
12	19 ±2 dBm	7	16 ±3 dBm	7	16 ±3 dBm
13	17 ±2 dBm	8	14 ±3 dBm	8	14 ±3 dBm
14	15 ±2 dBm	9	12 ±4 dBm	9	12 ±4 dBm
15	13 ±2 dBm	10	10 ±4 dBm	10	10 ±4 dBm
16	11 ±3 dBm	11	8 ±4dBm	11	8 ±4dBm
17	9 ±3dBm	12	6 ±4 dBm	12	6 ±4 dBm
18	7 ±3 dBm	13	4 ±4 dBm	13	4 ±4 dBm
19	5 ±3 dBm	14	2 ±5 dBm	14	2 ±5 dBm
		15	0 ±5 dBm	15	0 ±5 dBm

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## 2. SGH-P100 Circuit Description

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### 1. SGH-P100 RF Circuit Description

#### 1) RX PART

1. ASM(U1001) Switching Tx, Rx path for GSM900, DCS1800 and PCS1900 by logic controlling.

2. ASM Control Logic (U701, U702, U703) Truth Table

	VC1	VC2	VC3
GSM Tx Mode	H	L	L
DCS / PCS Tx Mode	L	H	L
PCS Rx Mode	L	L	H
GSM / DCS Rx Mode	L	L	L

#### 3. FILTER

To convert Electromagnetic Field Wave to Acoustic Wave and then pass the specific frequency band.

- GSM FILTER (C1003,C1004,L1001) For filtering the frequency band between 925 ~ 960 MHz
- DCS FILTER (C1005,C1006,L1002) For filtering the frequency band 1805 and 1880 MHz.
- PCS SAW FILTER (F1003) For filtering the frequency band between 1930 and 1990 MHz

#### 4. TC-VCXO (OSC901)

To generate the 13MHz reference clock to drive the logic and RF.

After additional process, the reference clock applies to the U900 Rx IQ demodulator and Tx IQ modulator.

The oscillator for RX IQ demodulator and Tx modulator are controlled by serial data to select channel and use fast lock mode for GPRS high class operation.

#### 5. SI 4205 (U900)

This chip integrates three differential-input LNAs.

The GSM input supports the E-GSM, DCS input supports the DCS1800, PCS input supports the PCS1900. The LNA inputs are matched to the 150 ohm differential output SAW filters through external LC matching network.

Image-reject mixer downconverts the RF signal to a 100 KHz intermediate frequency(IF) with the RFLO from frequency synthesizer. The RFLO frequency is between 1737.8 ~ 1989.9 MHz.

The Mixer output is amplified with an analog programmable gain amplifier(PGA), which is controlled by AGAIN.

The quadrature IF signal is digitized with high resolution A/D converts (ADC).

Also, this chip down-converts the ADC output to baseband with a digital 100 KHz quadrature LO signal. Digital decimation and IIR filters perform channel selection to remove blocking and reference interface signals.

After channel selection, the digital output is scaled with a digital PGA, which is controlled with the DGAIN. DACs drive a differential analog signal onto the RXIP, RXIN, RXQP, RXQN pins to interface to standard analog-input baseband IC.

## 2) TX PART

Baseband IQ signal fed into offset PLL, this function is included inside of U900 chip.

SI4205 chip generates modulator signal which power level is about 1.5dBm and fed into Power Amplifier(U1000).

The PA output power and power ramping are well controlled by Auto Power Control circuit. We use offset PLL below

Modulation Spectrum	200kHz offset 30 kHz bandwidth	GSM	-35dBc
		DCS	-35dBc
		PCS	-35dBc
	400kHz offset 30 kHz bandwidth	GSM	-66dBc
		DCS	-65dBc
		PCS	-66dBc
	600kHz ~ 1.8MHz offset 30 kHz bandwidth	GSM	-75dBc
		DCS	-68dBc
		PCS	-75dBc

## 2. Baseband Circuit description of SGH-P100

### 1. PSC2006

#### 1.1. Power Management

Seven low-dropout regulators designed specifically for GSM applications power the terminal and help ensure optimal system performance and long battery life. A programmable boost converter provides support for 1.8V, 3.0V, and 5.0V SIMs, while a self-resetting, electronically fused switch supplies power to external accessories. Ancillary support functions, such as an LED driver and two call-alert drivers, aid in reducing both board area and system complexity.

A three-wire serial interface unit(SIU) provides access to control and configuration registers. This interface gives a microprocessor full control of the PSC2006 and enables system designers to maximize both standby and talk times. Supervisory functions, including a reset generator, an input voltage monitor, and a thermal monitor, support reliable system design. These functions work together to ensure proper system behavior during start-up or in the event of a fault condition(low microprocessor voltage, insufficient battery energy, or excessive die temperature).

#### 1.2. Battery Charge Management

A battery charge management block provides fast, efficient charging of a single-cell Li-ion battery. Used in conjunction with a current-limited voltage source and an external PMOS pass transistor, this block safely conditions near-dead cells and provides the option of having fast-charge and top-off controlled internally or by the system's microprocessor.

#### 1.3. Backlight LED Driver

The backlight LED driver is a low-side, programmable current source designed to control the brightness of the keyboard and LCD illumination. The driver is enabled by EN\_LED, and its current setting is determined by LED[0:2]. Provided EN\_LED is '1', the driver can be programmed to sink from 12.5mA to 100mA in 12.5mA steps. LED\_DRV is capable of sinking 100mA at a worst-case maximum output voltage of 0.6V. For efficient use, the LEDs is connected between the battery and the LED\_DRV output.

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#### 1.4. Vibrator Motor Driver

The vibrator motor driver is a low-side, programmable voltage source designed to drive a small dc motor that silently alerts the user of an incoming call. The driver is enabled by EN\_VIB, and its voltage setting is determined by VIB[0:2]. Provided EN\_VIB is a logic 1, the driver can be programmed to maintain a motor voltage of 1.1V to 2.5V in 20mV steps and while sinking up to 100mA. For efficient use, the vibrator motor should be connected between the main battery and the VIB\_DRV output.

### 2. Connector

#### 2-1. LCD Connector

LCD is consisted of main LCD(color 65K STN LCD) and small LCD(4-gray LCD). Chip select signals of EMI part in the trident, CLCD\_EN\_FO and GLCD\_EN\_FO, can enable Each LCD. LED\_EN\_FO signal enables white LED of main LCD and EL\_EN\_FO signal enables EL of small LCD. These two signals are from IO part of the DSP in the trident. RST signal from 2006 initiates the initial process of the LCD.

16-bit data lines(D(0)\_FO~D(15)\_FO) transfers data and commands to LCD through emi\_filter. Data and commands use A(2)\_FO signal. If this signal is high, Inputs to LCD are commands. If it is low, Inputs to LCD are data. The signal which informs the input or output state to LCD, is required. But this system is not necessary this signal. So CP\_WEN\_FO signal is used to write data or commands to LCD. Power signals for LCD are V\_bat and V\_ccd. SPK1P and SPK1N from CSP1093 are used for audio speaker. And VIB\_EN\_FO from enables the motor.

#### 2-2. JTAG Connector

Trident has two JTAG ports which are for ARM core and DSP core(DSP16000). So this system has two port connector for these ports. Pins ' initials for ARM core are ' CP\_ ' and pins ' initials for DSP core are ' DSP\_ '. CP\_TDI and DSP\_TDI signal are used for input of data. CP\_TDO and DSP\_TDO signals are used for the output of the data. CP\_TCK and DSP\_TCK signals are used for clock because JTAG communication is a synchronous. CP\_TMS and DSP\_TMS signals are test mode signals. The difference between these is the RESET\_INT signal which is for ARM core RESET.

#### 2-3. IRDA

This system uses IRDA module, HSDL\_3201, HP ' s. This has signals, IRDA\_EN(enable signal), IRDA\_RX(input data) and IRDA\_TX(output data). These signals are connected to PPI of trident. It uses two power signals. V\_ccd is used for circuit and V\_bat is used for LED.

#### 2-4. Keypad connector

This is consisted of key interface pins among PPI in the trident, KEY\_ROW[0~4] and KEY\_COL[0~4]. These signals compose the matrix. Result of matrix informs the key status to key interface in the trident. Some pins are connected to varistor for ESD protection. And power on/off key is separated from the matrix. So power on/off signal is connected with PSC2006 to enable PSC2006. SVC\_GREEN, SVC\_RED and SVC\_BLUE are from OCTL of CSP1093. These signals decide the color of LED, service indicator. Eighteen key LED use the V\_bat supply voltage. These are connected to BACKLIGHT signal in the PSC2006. This signal enables LEDs with current control. FLIP\_SNS informs the status of folder (open or closed) to the trident. This uses the hall effect IC, A3210ELH. A magnet under main LCD enables A3210ELH which is on the key FPCB.

### 3. IF connector

It is 24-pin connector, and uses 18-pin at present. They are designed to use SDS, DEBUG, DLC-DETECT, JIG\_ON, VEXT, VTEST, VF, CF, VBAT and GND. They connected to power supply IC, microprocessor and signal processor IC.

### 4. Audio

AOUTAP from CSP1093 is connected to the main speaker. AOUTAN is connected to the speaker via audio-amp. AOUTBN and AOUTBP are connected to the ear-mic speaker via ear-jack. MICIN and MICOUT are connected to the main MIC. And AUXIN and AUXOUT are connected to the Ear-mic.

YMU762MA3 is a LSI for portable telephone that is capable of playing high quality music by utilizing FM synthesizer and ADPCM decoder that are included in this device.

As a synthesis, YMU762MA3 is equipped 16 voices with different tones. Since the device is capable of simultaneously generating up to synchronous with the play of the FM synthesizer, various sampled voices can be used as sound effects. Since the play data of YMU762MA3 are interpreted at anytime through FIFO, the length of the data (playing period) is not limited, so the device can flexibly support application such as incoming call melody music distribution service. The hardware sequencer built in this device allows playing of the complex music without giving excessive load to the CPU of the portable telephones. Moreover, the registers of the FM synthesizer can be operated directly for real time sound generation, allowing, for example, utilization of various sound effects when using the game software installed in the portable telephone.

YMU759 includes a speaker amplifier with high ripple removal rate whose maximum output is 550mW (SPVDD=3.6V). The device is also equipped with conventional function including a vibrator and a circuit for controlling LEDs synchronous with music.

For the headphone, it is provided with a stereophonic output terminal.

For the purpose of enabling YMU762MA3 to demonstrate its full capabilities, Yamaha purpose to use "SMAF: Synthetic music Mobile Application Format" as a data distribution format that is compatible with multimedia. Since the SMAF takes a structure that sets importance on the synchronization between sound and images, various contents can be written into it including incoming call melody with words that can be used for training karaoke, and commercial channel that combines texts, images and sounds, and others. The hardware sequencer of YMU762MA3 directly interprets and plays blocks relevant to synthesis (playing music and reproducing ADPCM with FM synthesizer) that are included in data distributed in SMAF.

### 5. Memory

This system uses SHARP's memory, LRS1828. It is consisted of 128M bits flash memory and 32M bits SRAM. It has 16 bit data line, D[0~15] which is connected to trident, LCD or CSP1093. It has 22 bit address lines, A[1~22]. They are connected too. CP\_CSROMEN and CO\_CSROM2EN signals, chip select signals in the trident enable two memories. They use 3 volt supply voltage, V<sub>ccd</sub> and 1.8 volt supply voltage, V<sub>cc</sub>1.8a in the PSC2006. During writing process, CP\_WEN is low and it enables writing process to flash memory and SRAM. During reading process, CP\_OEN is low and it output information which is located at the address from the trident in the flash memory or SRAM to data lines. Each chip select signals in the trident select memory among 2 flash memory and 2 SRAM. Reading or writing procedure is processed after CP\_WEN or CP\_OEN is enabled. Memories use FLASH\_RESET, which is buffered signal of RESET from PSC2006, for ESD protection. A[0] signal enables lower byte of SRAM and UPPER\_BYTE signal enables higher byte of SRAM.



## 6. Trident

Trident is consisted of ARM core and DSP core. It has 20K\*16bits RAM 144K\*16bits ROM in the DSP. It has 4K\*32bits ROM and 2K\*32bits RAM in the ARM core. DSP is consisted of timer, one bit input/output unit(BIO), JTAG, EMI and HDS(Hardware Development System). ARM core is consisted of EMI, PIC(Programmable Interrupt Controller), reset/power/clock unit, DMA controller, TIC(Test Interface Controller), peripheral bridge, PPI, SSI(Synchronous Serial Interface), ACC(Asynchronous communications controllers), timer, ADC, RTC(Real-Time Clock) and keyboard interface. DSP\_AB[0~8], address lines of DSP core and DSP\_DB[0~15], data lines of DSP core are connected to CSP1093. A[0~20], address lines of ARM core and D[0~15], data lines of ARM core are connected to memory, LCD and YMU759. ICP(Interprocessor Communication Port) controls the communication between ARM core and DSP core. CSROMEN, CSRAMEN and CS1N to CS4N in the ARM core are connected to each memory. WEN and OEN control the process of memory. External IRQ(Interrupt ReQuest) signals from each units, such as, YMU, Ear-jack, Ear-mic and CSP1093, need the compatible process. Some PPI pins has many special functions. CP\_KB[0~9] receive the status from key FPCB and are used for the communications using IRDA(IRDA\_RX/TX/EN) and data link cable(DEBUG\_DTR/RTS/TXD/RXD/CTS/DSR). And UP\_CS/SCLK/SDI, control signals for PSC2006 are outputted through PPI pins. It has signal port for charging(CHG\_DET, CHG\_STAT0), SIM\_RESET and FLIP\_SNS with which we knows open.closed status of folder. It has JTAG control pins(TDI/TDO/TCK) for ARM core and DSP core. It receives 13MHz clock in CKI pin from external TCXO and receives 32.768KHz clock from X1RTC. ADC(Analog to Digital Convertor) part receives the status of temperature, battery type and battery voltage. And control signals(DSP\_INT, DSP\_IO and DSP\_RWN) for DSP core are used. It enables main LCD and small LCD with DSP IP pins.

## 7. CSP1093

CSP1093 integrates the timing and control functions for GSM 2+ mobile application with the ADC and DAC functions. The CSP1093 interfaces to the trident, via a 16-bit parallel interface. It serves as the interface that connects a DSP to the RF circuitry in a GSM 2+ mobile telephone. DSP can load 148 bits of burst data into CSP1093's internal register, and program CSP1093's event timing and control register with the exact time to send the burst. When the timing portion of the event timing and control register matches the internal quarter-bit counter and internal frame counter, the 148 bits in the internal register are GMSK modulated according to GSM 2+ standards. The resulting phase information is translated into I and Q differential output voltages that can be connected directly to an RF modulator at the TXOP and TXON pins. The DSP is notified when the transmission is completed. For receiving baseband data, a DSP can program CSP1093's event timing and control register with the exact time to start receiving I and Q samples through TXIP and TXIN pins. When that time is reached, the control portion of the event timing and control register will start the baseband receive section converting I and Q sample pairs. The samples are stored in a double-buffered register until the register contains 32 sample pairs. CSP1093 then notifies the DSP which has ample time to read the information out before the next 32 sample pairs are stored. The voice band ADC converter issues an interrupt to the DSP whenever it finishes converting a 16-bit PCM word. The DSP then reads the new input sample and simultaneously loads the voice band output DAC converter with a new PCM output word. The voice band output can be connected directly to a speaker via AOUTAN and AOUTAP pins and be connected to a Ear-mic speaker via AOUTBN and AOUTBP pins.

## 8. X-TAL(13MHz)

This system uses the 13MHz TCXO, TCO-9141B, Toyocom. AFC control signal from CSP1093 controls frequency from 13MHz x-tal. It generates the clock frequency. This clock is inverted through NOT gate, TC7S04FU and is connected to CSP1093. 13MHz clock for YMU759 uses a not-inverted clock. Clock for RF parts uses same type.

#### 9. Camera DSP(LC99704B)

- This chipset is MCP product that combines the CCD Driver with on-chip booster circuit and analogue/digital mixed-signal processing IC.

The booster circuit generate the supply voltages required for CCD drive.

Cameras can use either a +2.8V or +3.0V or +3.3V only power supply system.

The analogue / digital mixed-signal processing IC that integrates the signal-processing functions required in a CCD digital camera and a rich set of additional functions on a single chip. Although the CDS(correlated dual sampling) and AGC circuit required for analog processing and the clamp circuit required for A/D conversion are normally provided on circuits, as well as an A/D converter, on a single chip.

Additionally, it also includes the pulse generator circuits required for CCD drive, the logic circuits for the electronics iris, and the digital signal-processing circuits required to create the digital YUV signal output. This device can take advantage of the features of these digital signal-processing functions to provide auto white balance, automatic dropout detection and correction, mirror image output, and a single line of memory to provide flexibility in the external interface.

This device assumes an internal master clock frequency in the range 16 ~27 MHz.

Normally , either an external clock with that frequency is provided, or else a master clock oscillator circuit is constructed using the built-in oscillator inverter circuit.

And this is also possible to control the CCD drive internal and external.

#### 10. Camera ASIC(SSH 275)

This ASIC interfaces between CCD and LCD, and this chip compresses and expands input pictures from CCD with JPEG format.

- CCD I/F : YUV422(16 bit) format, CIF fixed size.

System clock providing CCD module (13.5 MHz) and Dot clock providing CCD module (13.5 MHz).

- CPU I/F : Accessible to JPEG controller, a control register including, JPEG code buffer, and a thumbnail picture buffer.

Direct access to LCD controller by switching buses.

- LCD I/F : Support LCD controller.

Accessible by switching 2 masters of the Host CPU or ASIC picture processing .

Output format from ASIC is RGB565.

- I2C I/F : I2C master for CCD module control equipped.

CCD module is accessible from CPU without paying attention to I2C, as in the case of a normal register write/read.

- JPEG codec : YUV422 picture data is compressed to JPEG code, and JPEG code data is expanded to YUV422 picture data.

- Clock system : As for ASIC, 27 MHz clock input from outside is the main clock.

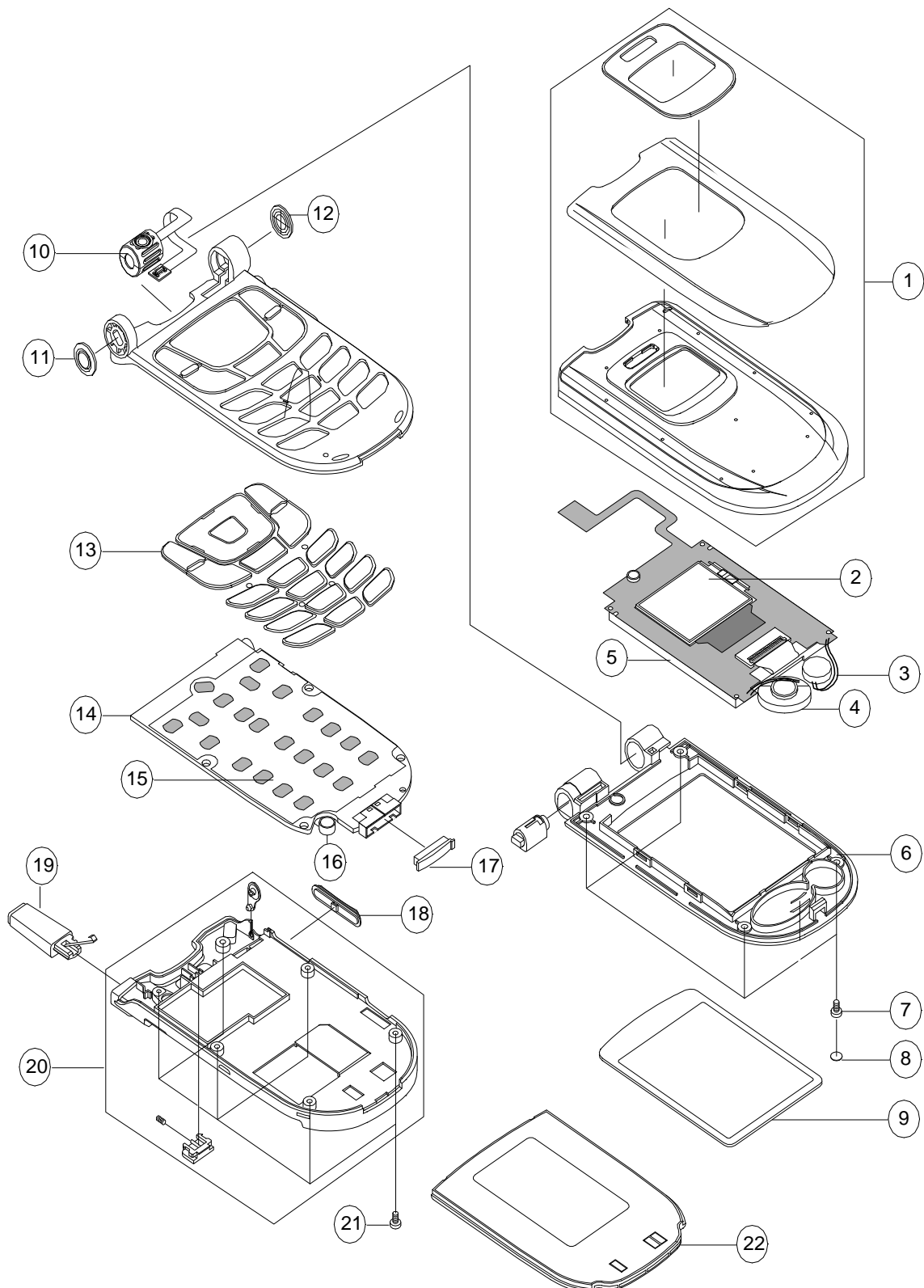
2-divided 13.5 MHz is used as CCD module main clock output, dot clock output to CCD module, and ASIC inner clock

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### 3. SGH-P100 Exploded View and its Parts list

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#### 1. Cellular phone Exploded View



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## 2. Cellular phone Parts list

Location NO.		Description	SEC CODE	Remark
1		FOLDER UPPER	GH75-03160A	
2		LCD FPCB	GH07-00358A	
3		MOTOR	3101-001336	
4		SPEAKER	3001-001427	
5		MAIN LCD	GH07-00253A	
6		FOLDER LOWER	GH75-03191A	
7		SCREW	6001-001478	
8		SCREW CAP	GH74-02775A	
9		MAIN WINDOW	GH75-03362A	
10		CAMERA	GH59-00806A	
11		SIDE DECO	GH72-08113A	
12		SIDE DECO	GH72-08113A	
13		KEYPAD	GH75-03148A	
14		MAIN PBA	GH92-01514A	
15		METAL DOME SHEET	GH59-00821A	
16		MIC	GH30-00029A	
17		IF COVER	GH73-02150A	
18		VOLKEY	GH75-03230A	
19		ANTENNA	GH42-00304A	
20		REAR COVER	GH75-03195A	
21		SCREW	6001-001155	
22		BATTERY	GH43-00906A	

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3. Test Jig (GH80-00001A)



3-1. RF Test Cable  
(GH39-00182A)



3-2. Test Cable  
(GH39-00122A)



3-3. Serial Cable



3-4. Power Supply Cable



3-5. DATA CABLE  
(GH39-00159A)



3-6. TA  
(GH44-00482A)



#### 4. SGH-P100 MAIN Electrical Parts List

SEC Code	Design LOC		
0404-001172	D1101	1204-001984	U700
0404-001172	D1102	1209-001219	U602
0404-001172	D1103	1209-001497	U101
0406-001083	ZD300	1405-001018	ZD308
0406-001083	ZD301	1405-001082	ZD201
0406-001152	ZD302	1405-001082	ZD303
0501-000225	Q400	1405-001082	ZD304
0504-000168	Q100	1405-001082	ZD305
0504-001151	U701	1405-001082	ZD306
0504-001151	U702	1405-001082	ZD307
0504-001151	U703	1405-001082	ZD401
0506-001052	U102	1405-001082	ZD402
0601-001547	LED801	1405-001082	ZD403
0601-001547	LED802	1405-001082	ZD405
0601-001547	LED803	1405-001082	ZD800
0601-001547	LED804	1405-001082	ZD801
0601-001547	LED805	1405-001082	ZD802
0601-001547	LED806	1405-001093	ZD309
0601-001547	LED807	2007-000138	R903
0601-001547	LED808	2007-000140	R302
0601-001547	LED809	2007-000140	R303
0601-001547	LED810	2007-000140	R304
0601-001547	LED812	2007-000140	R305
0604-001146	LED200	2007-000140	R306
0801-000796	U1105	2007-000140	R310
0801-000796	U1108	2007-000140	R311
0801-000796	U1109	2007-000140	R424
0801-002212	U1110	2007-000141	R113
0801-002727	U1107	2007-000141	R407
0801-002727	U1111	2007-000141	R420
0801-002727	U1112	2007-000144	R701
1009-001010	U802	2007-000146	R404
1109-001274	U500	2007-000148	R1104
1203-001720	U1104	2007-000148	R402
1203-002568	U100	2007-000148	R421
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2007-000172	R200
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2007-003010	R811
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2007-003010	R815
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2007-007107	R1008
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2007-007142	R111
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2007-007200	R106
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2007-007306	R1109
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2007-007306	R1112
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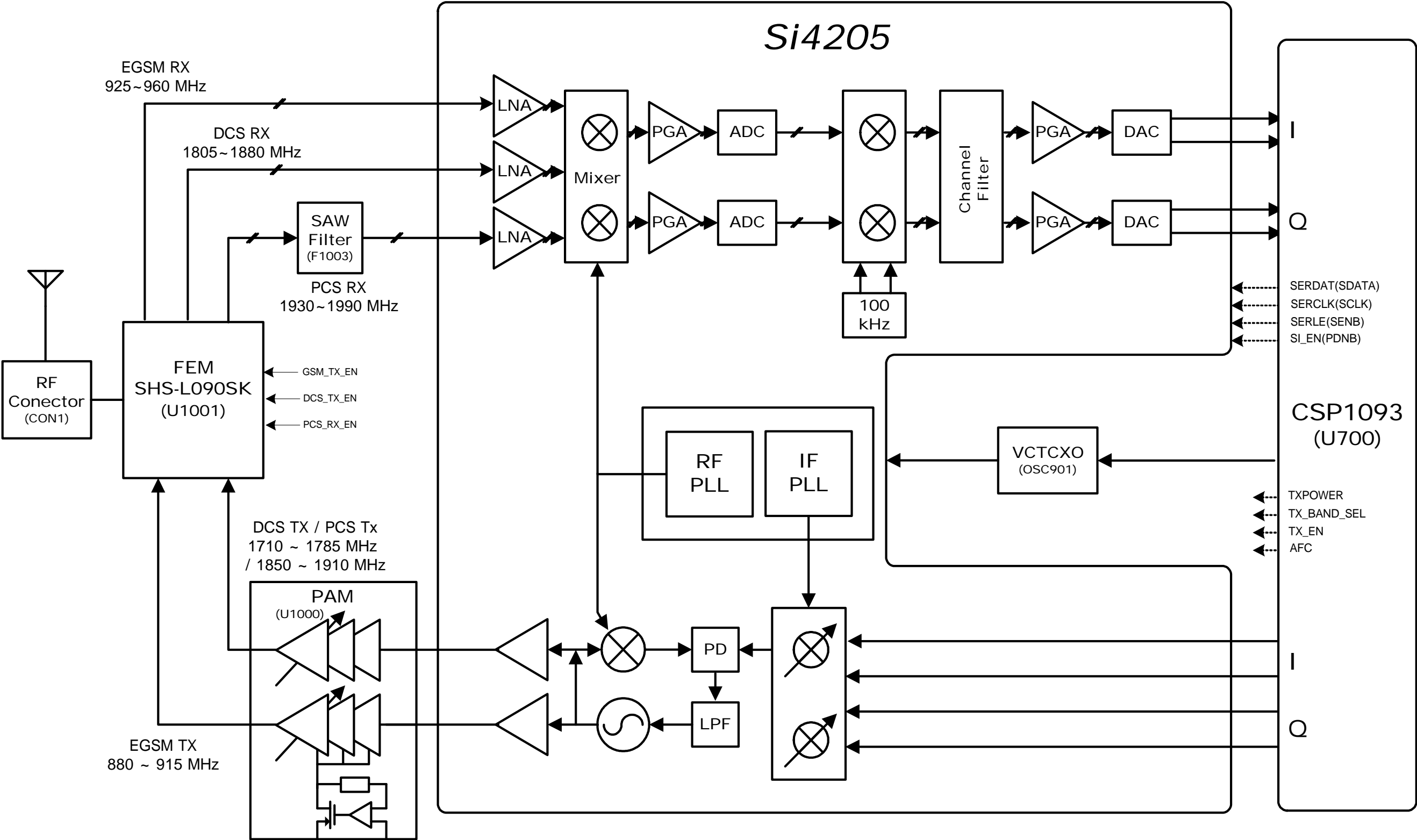
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5. SGH-P100 Block Diagrams

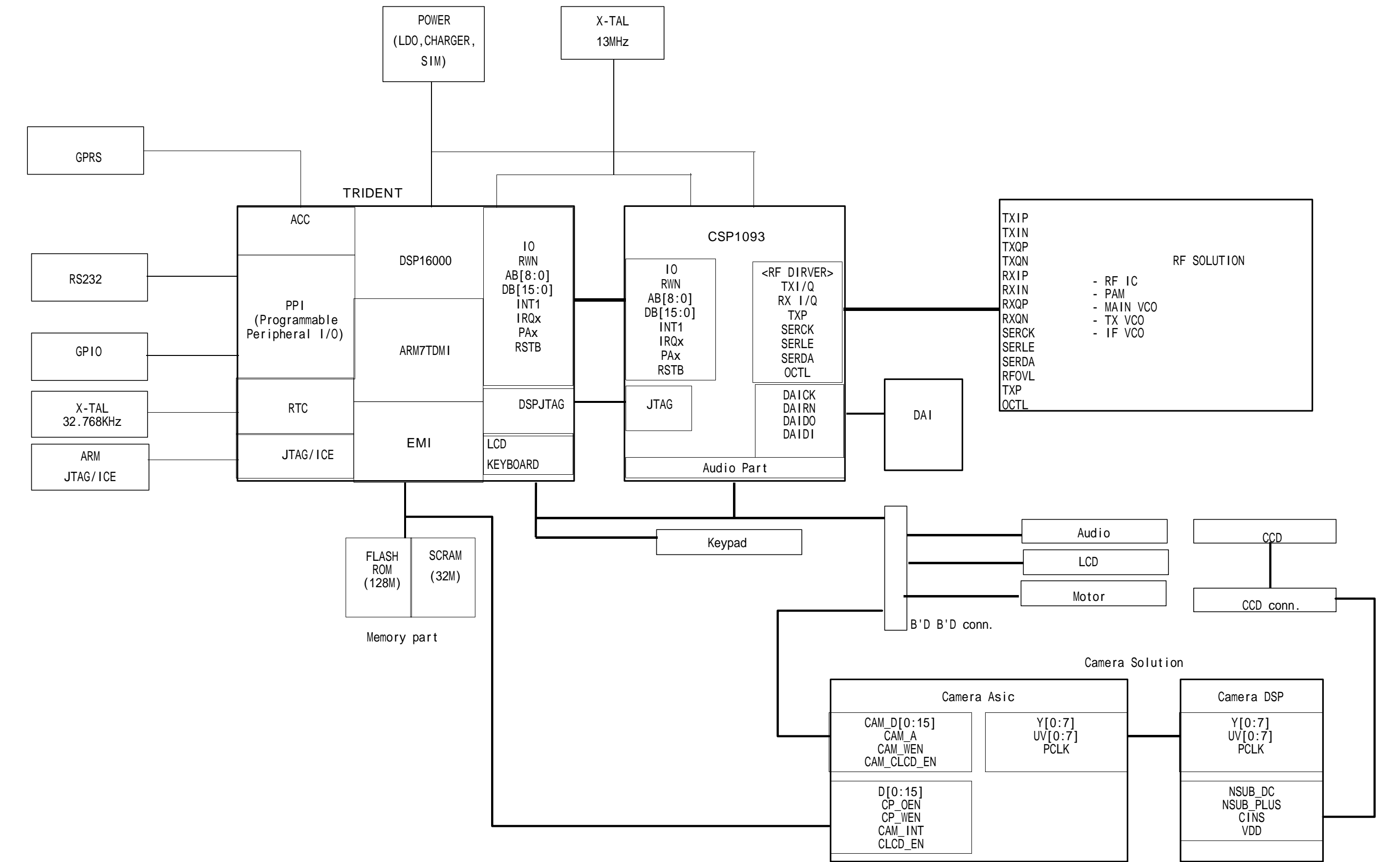
1. RF Solution Block Diagram



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2. Base Band Solution Block Diagram

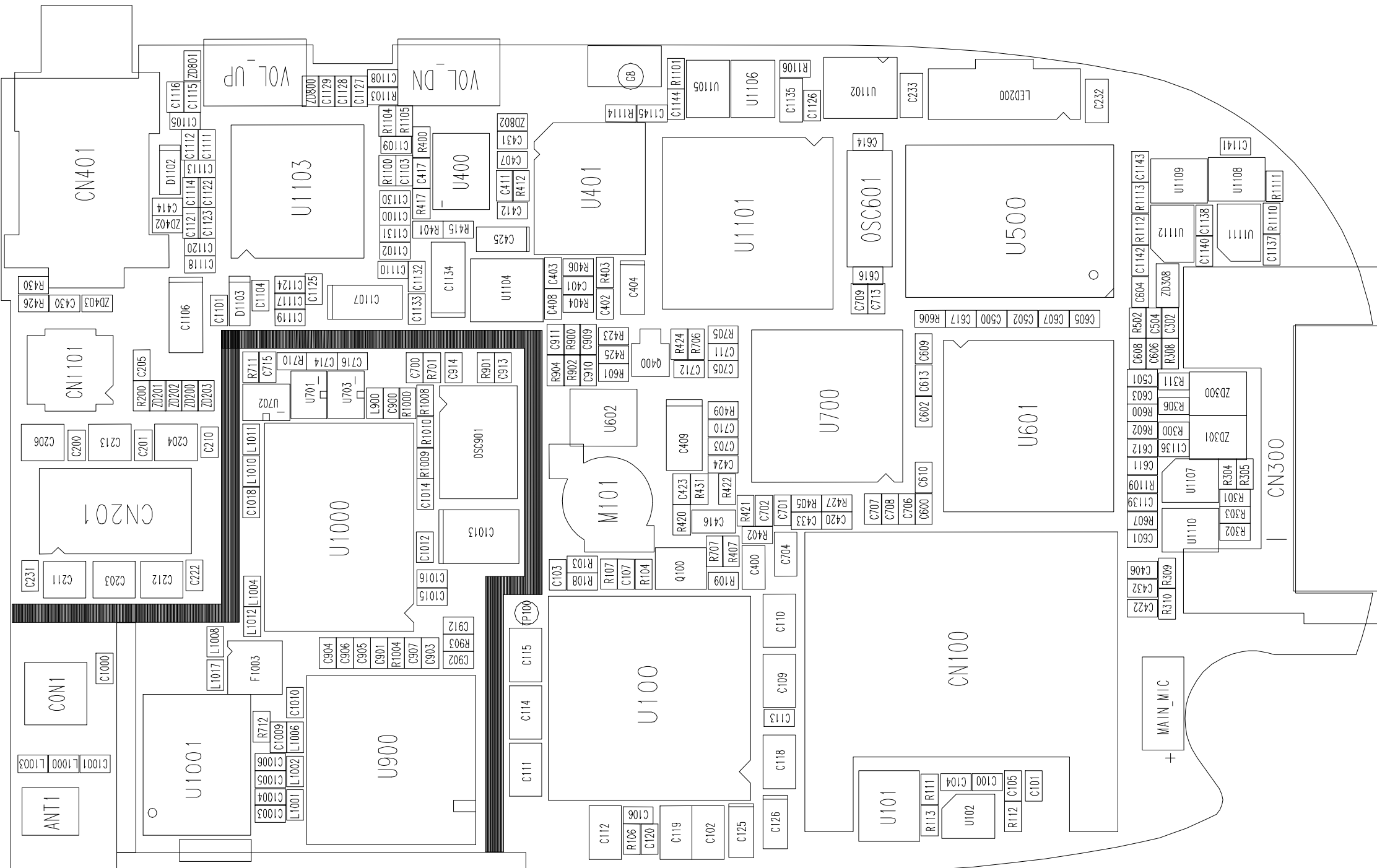


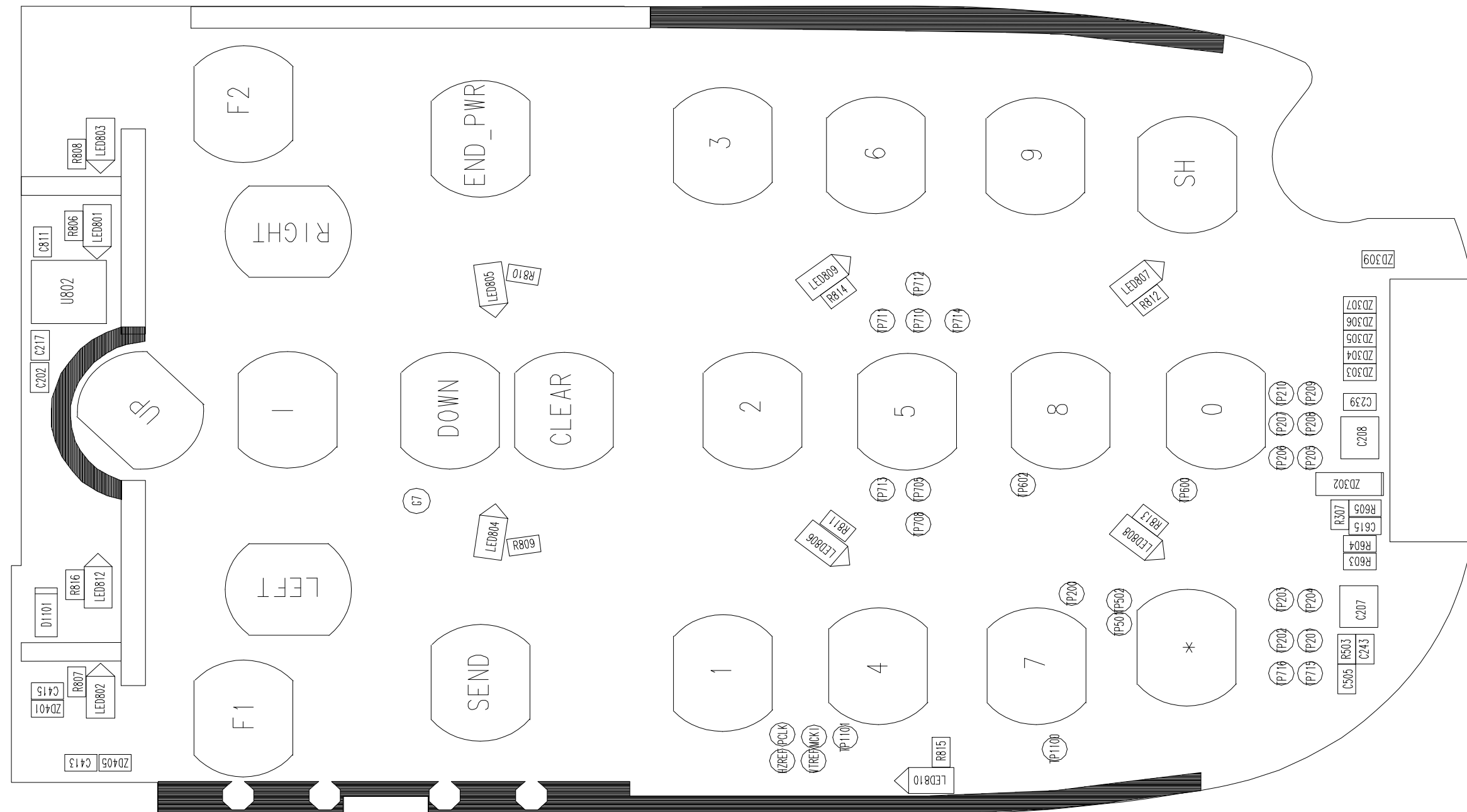
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## 6. SGH-P100 PCB Diagrams

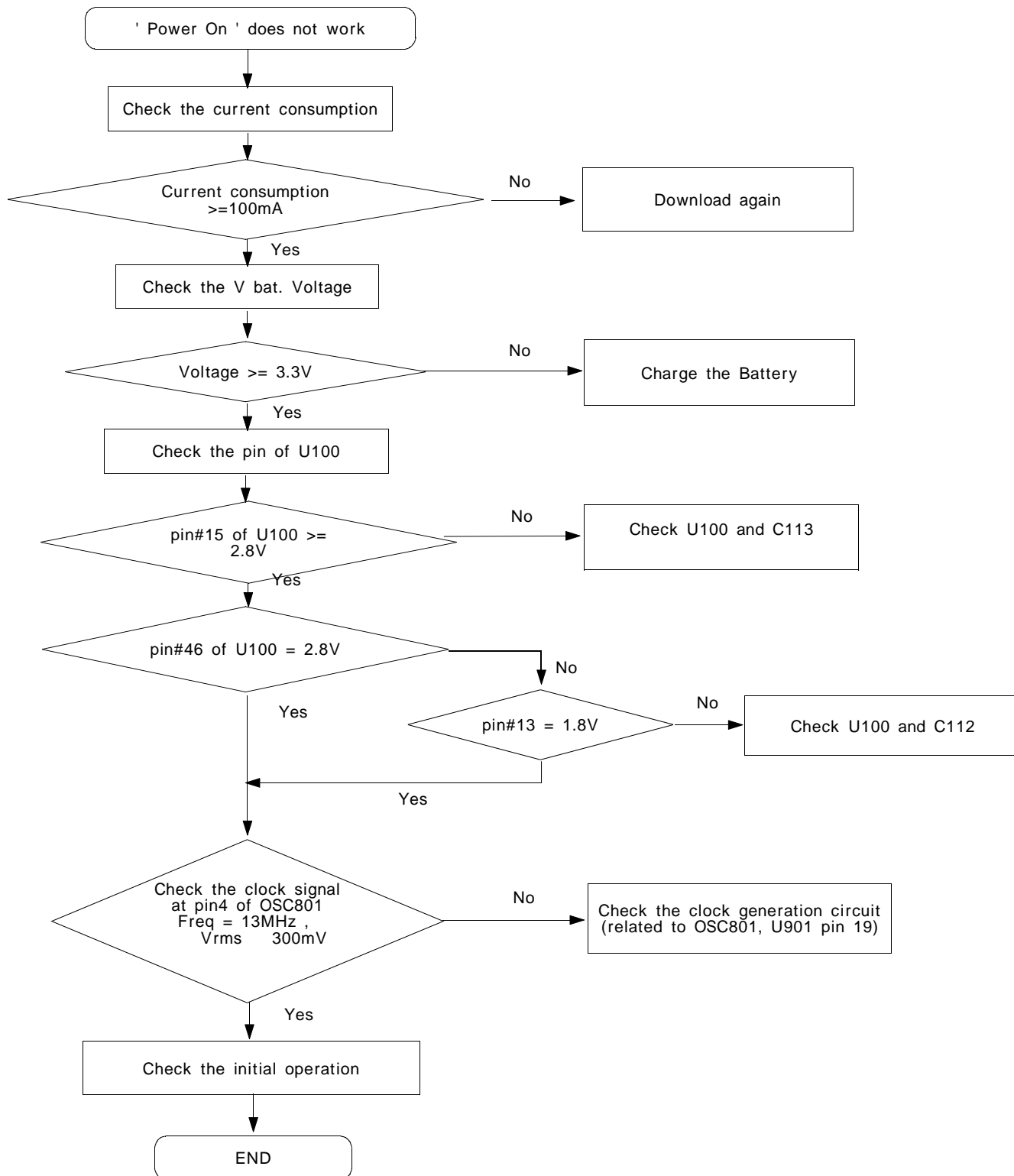
## 1. Main PCB Top Diagram





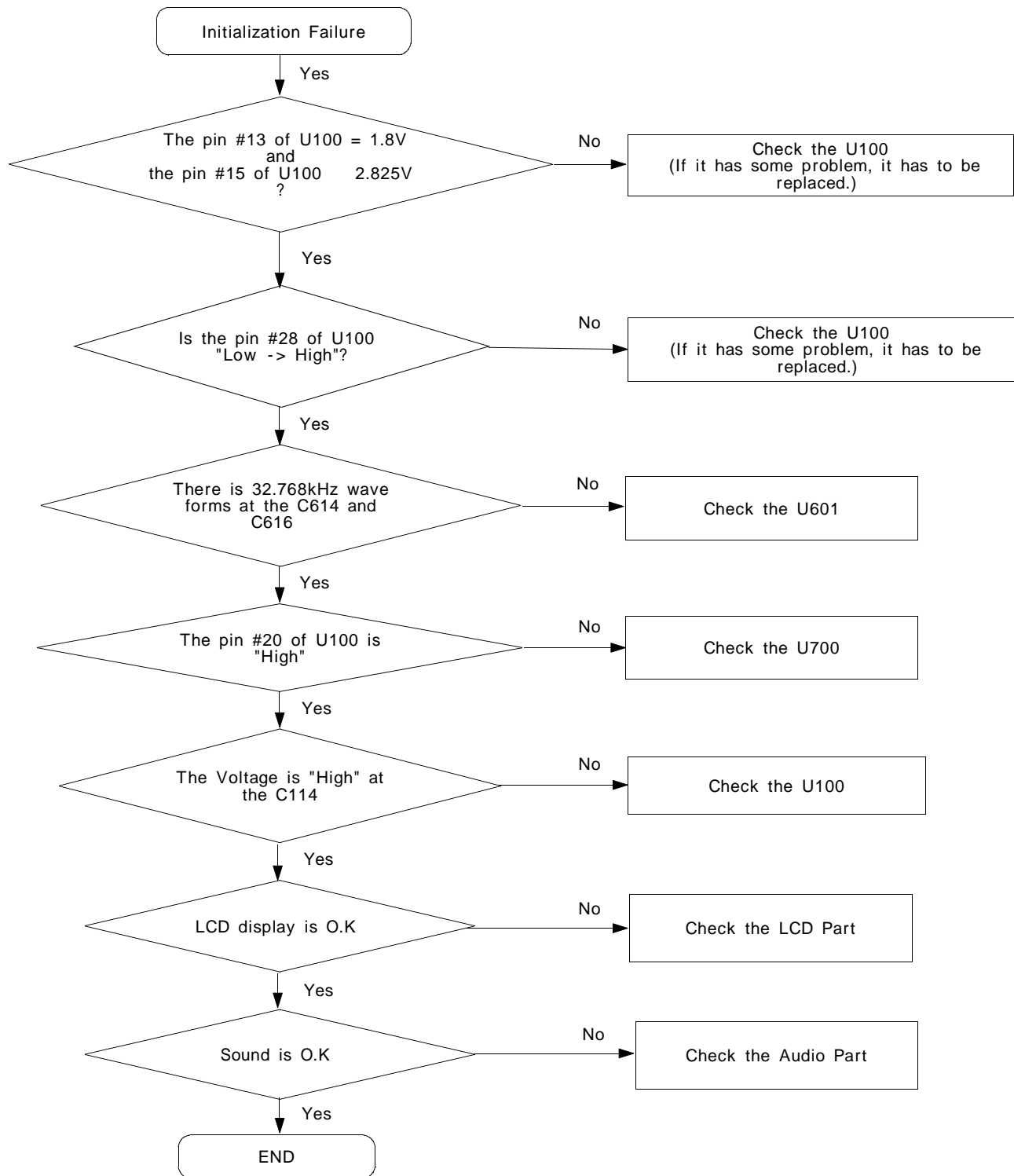
## 7. SGH-P100 Flow Chart of Troubleshooting

### 1. Power On

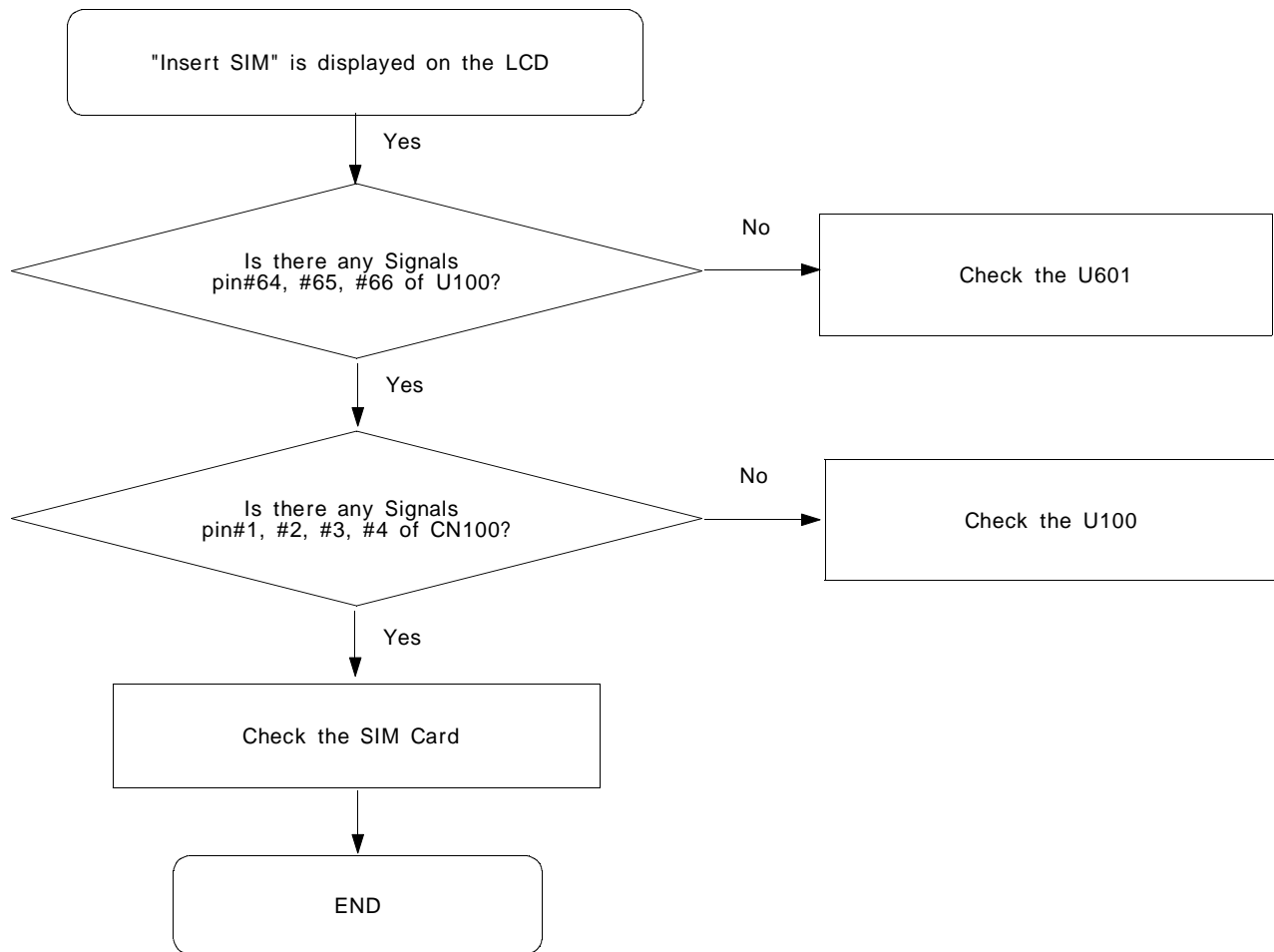




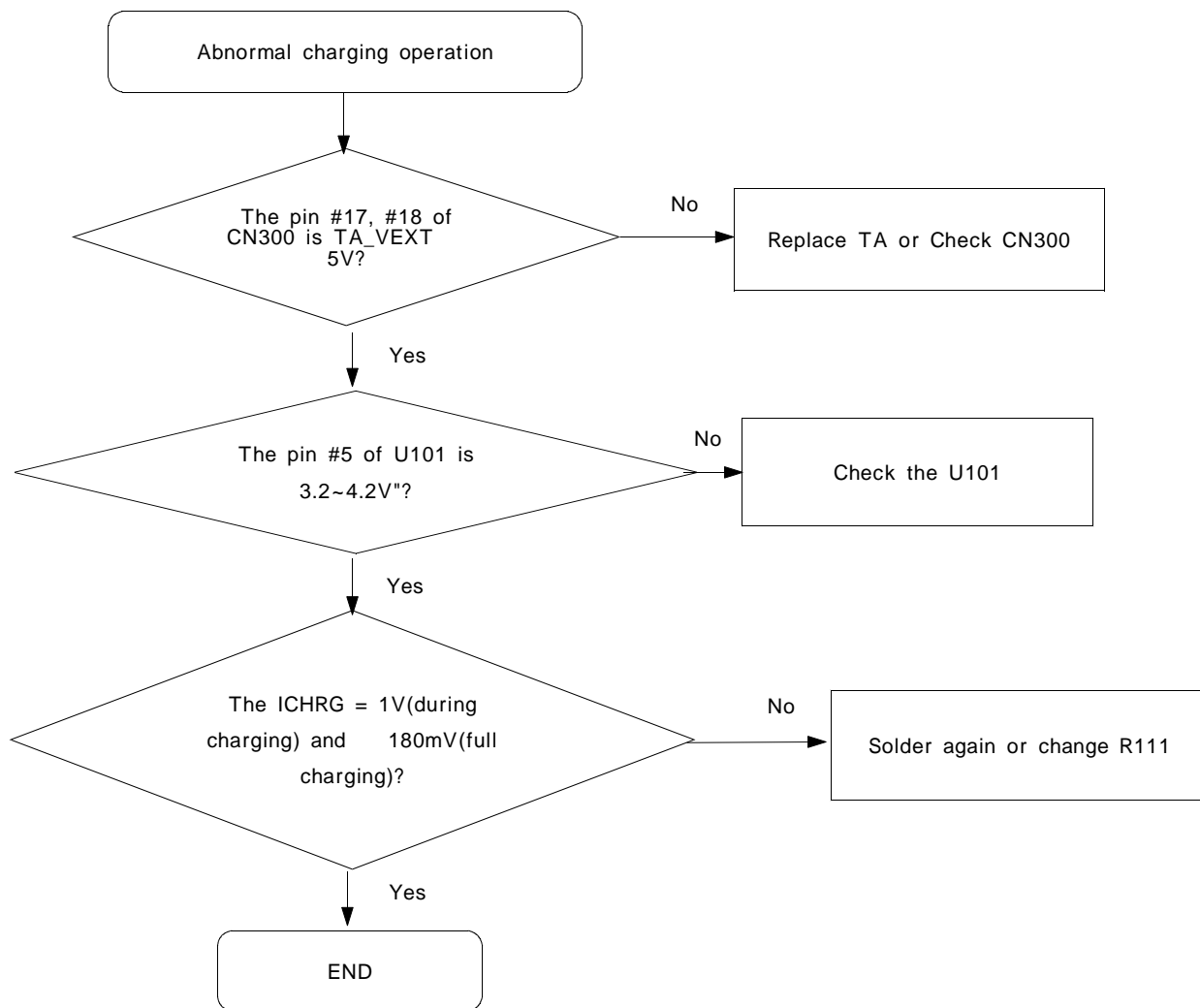
## 2. Initial

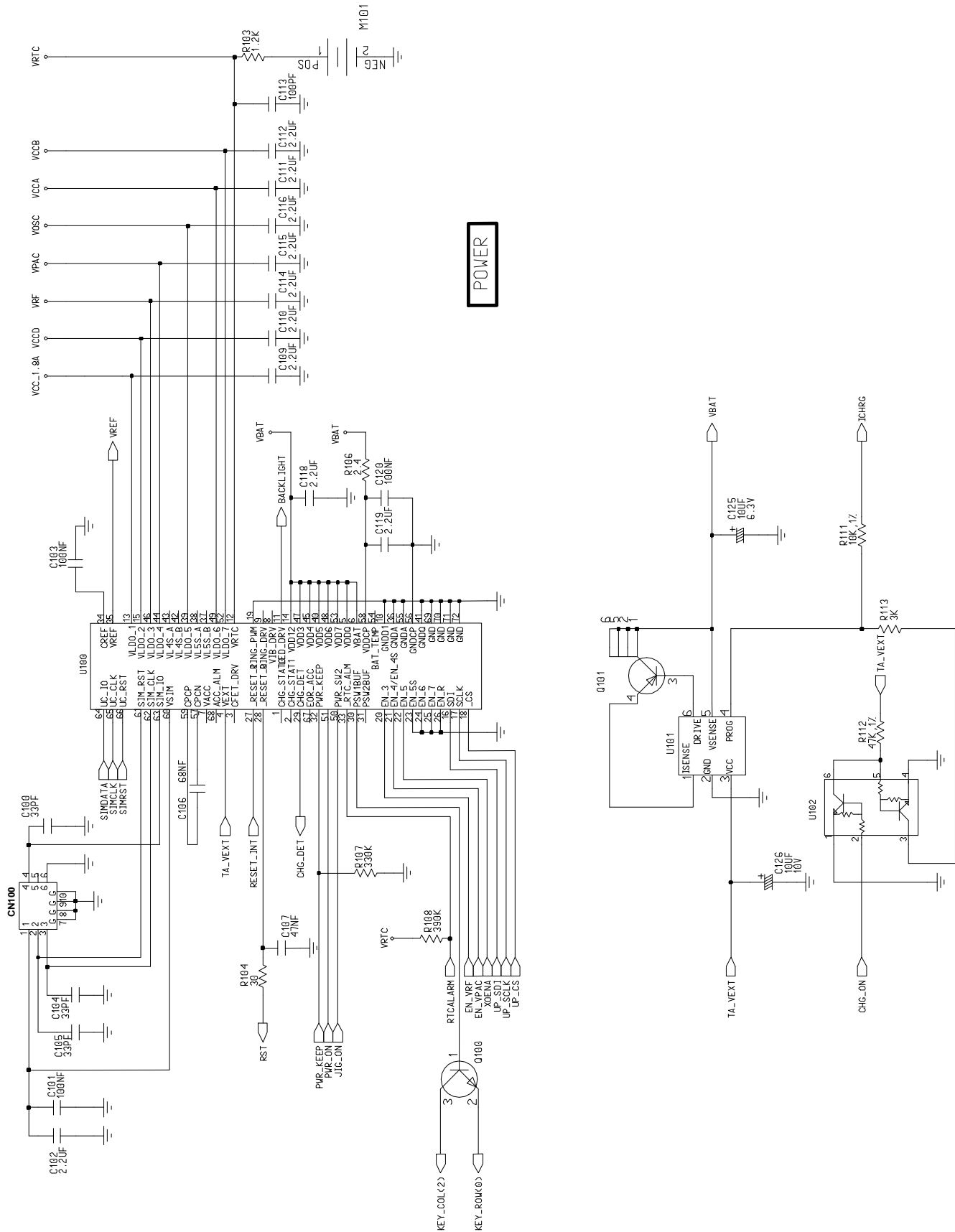


### 3. Sim Part



#### 4. Charging Part

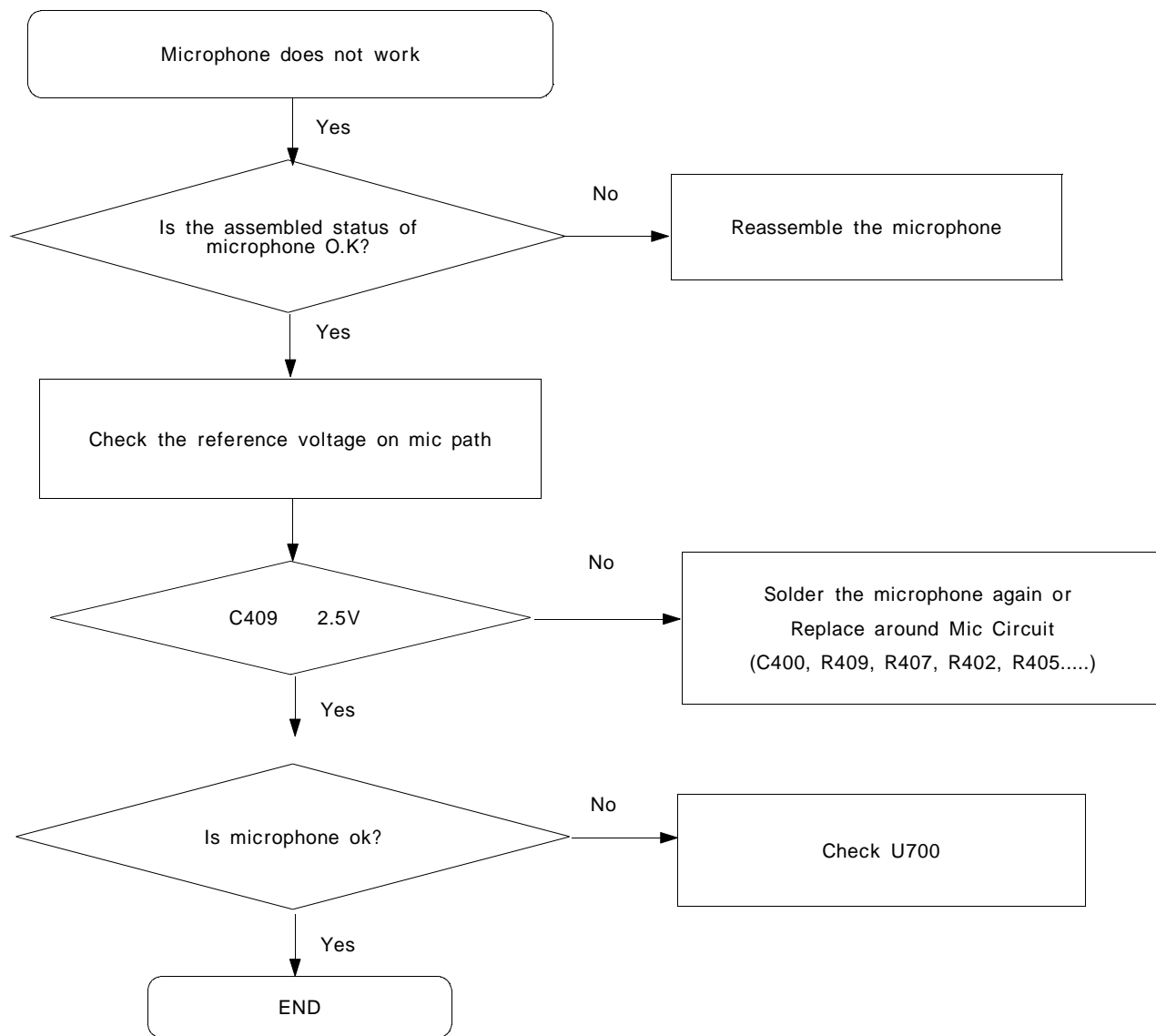




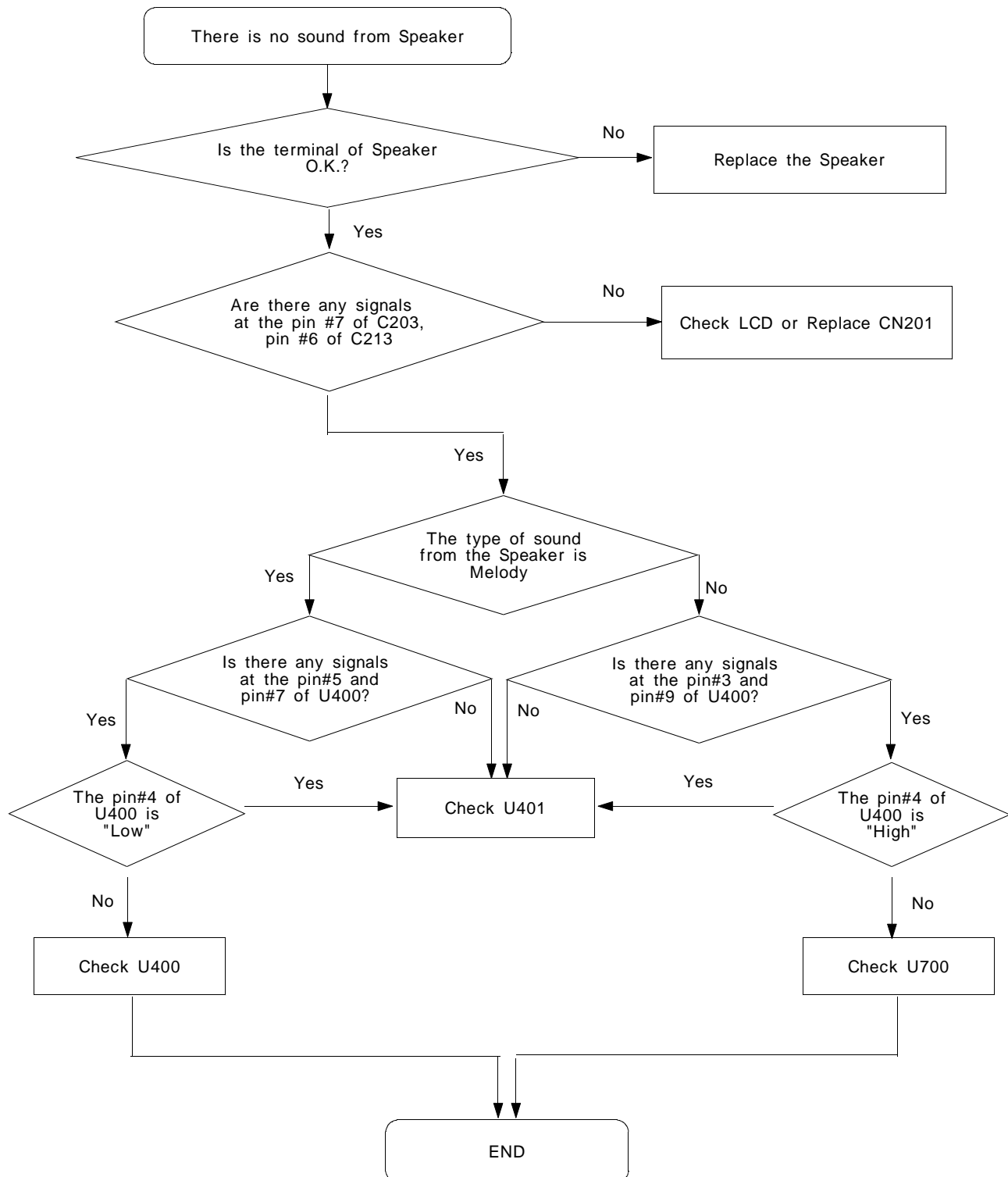
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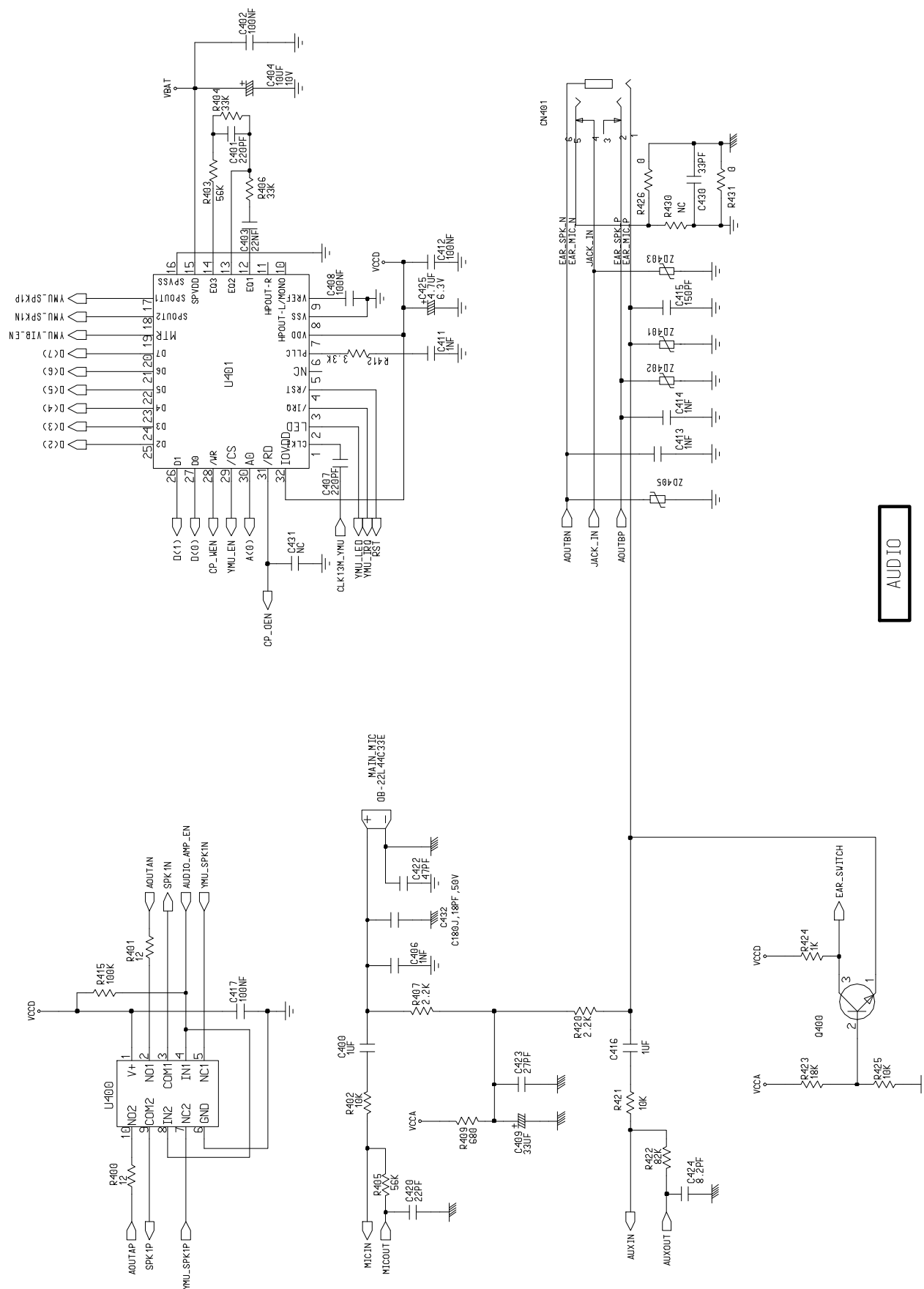
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## 5. Microphone Part



## 6. Speaker Part

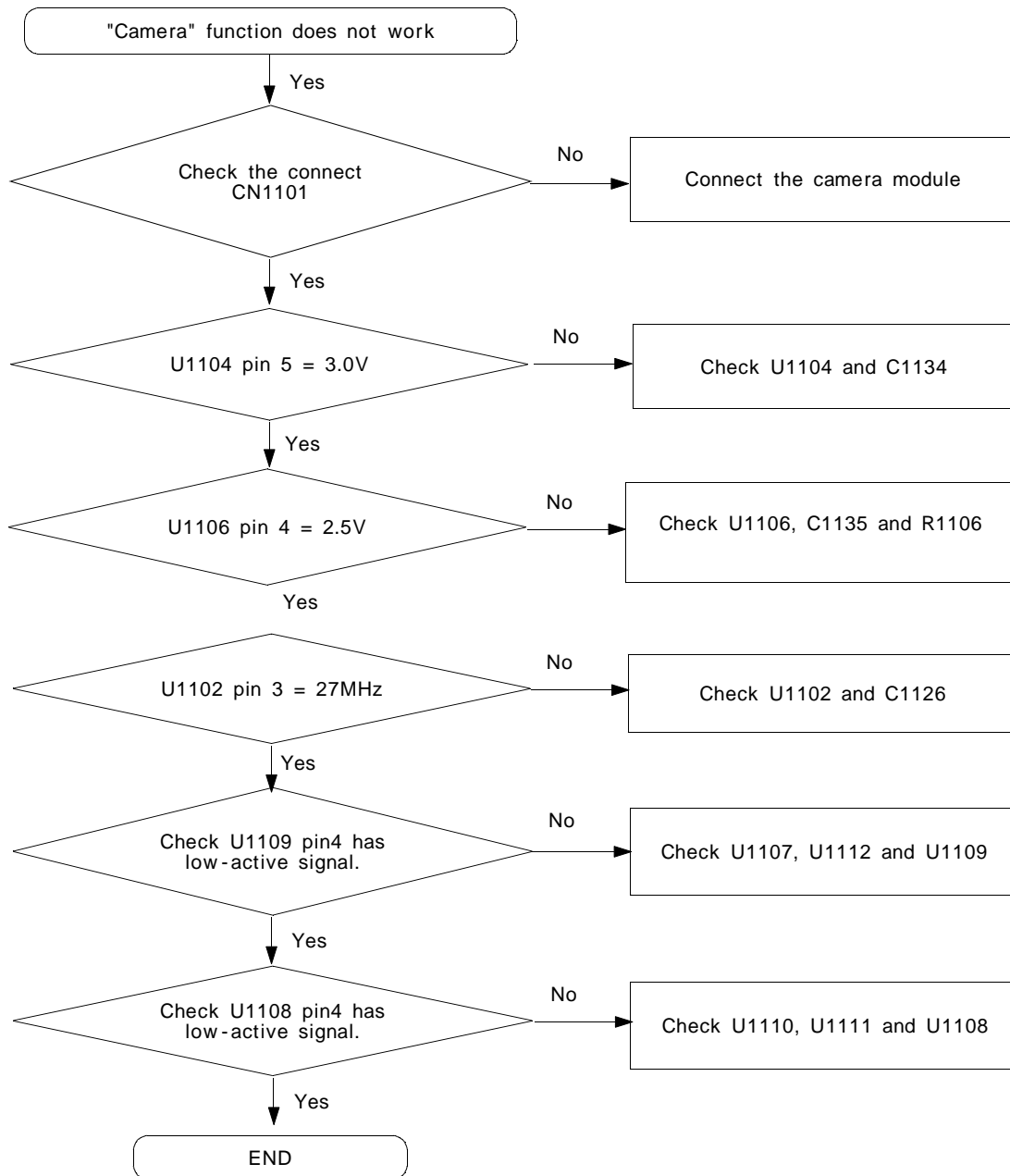




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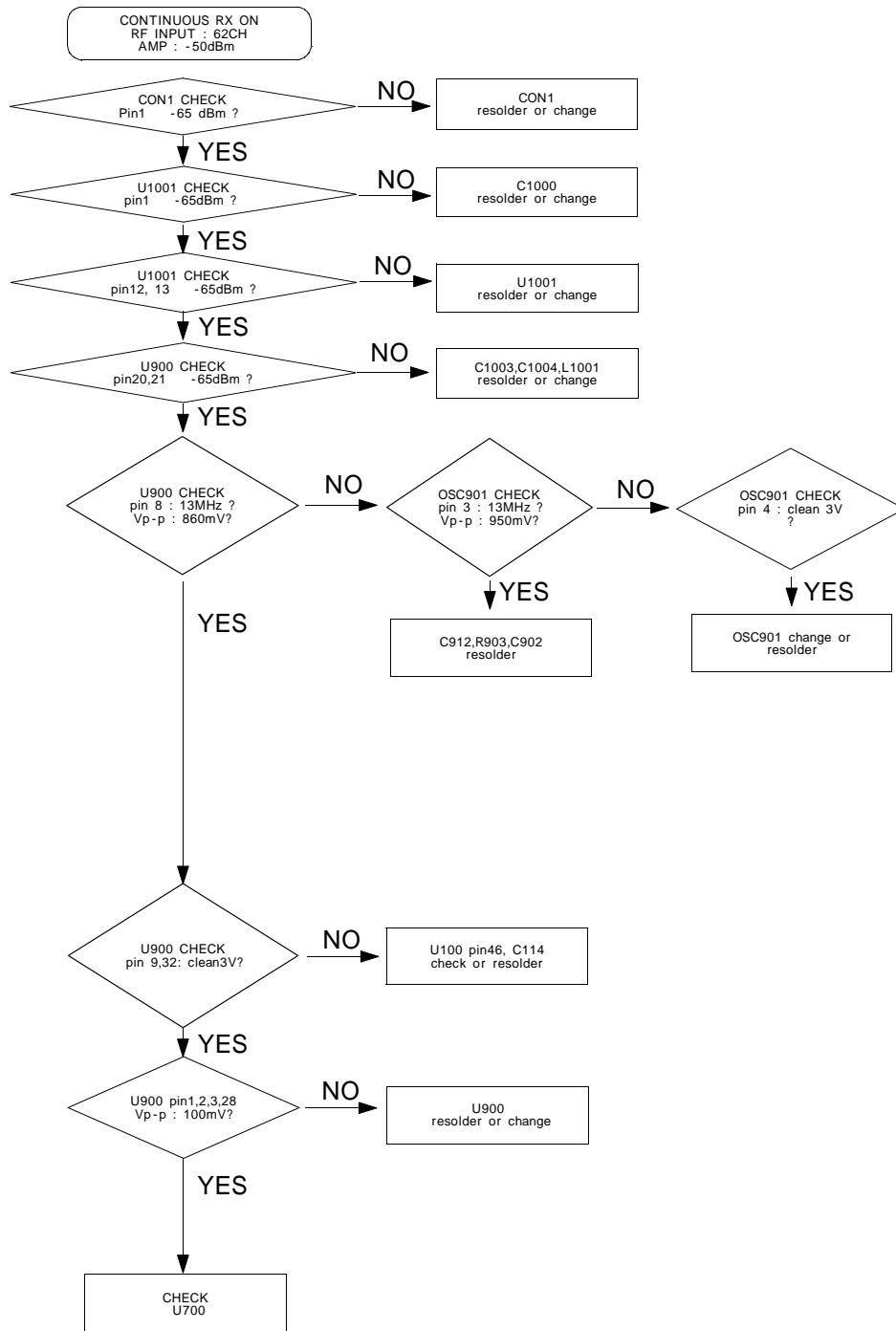
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## 7. Camera part

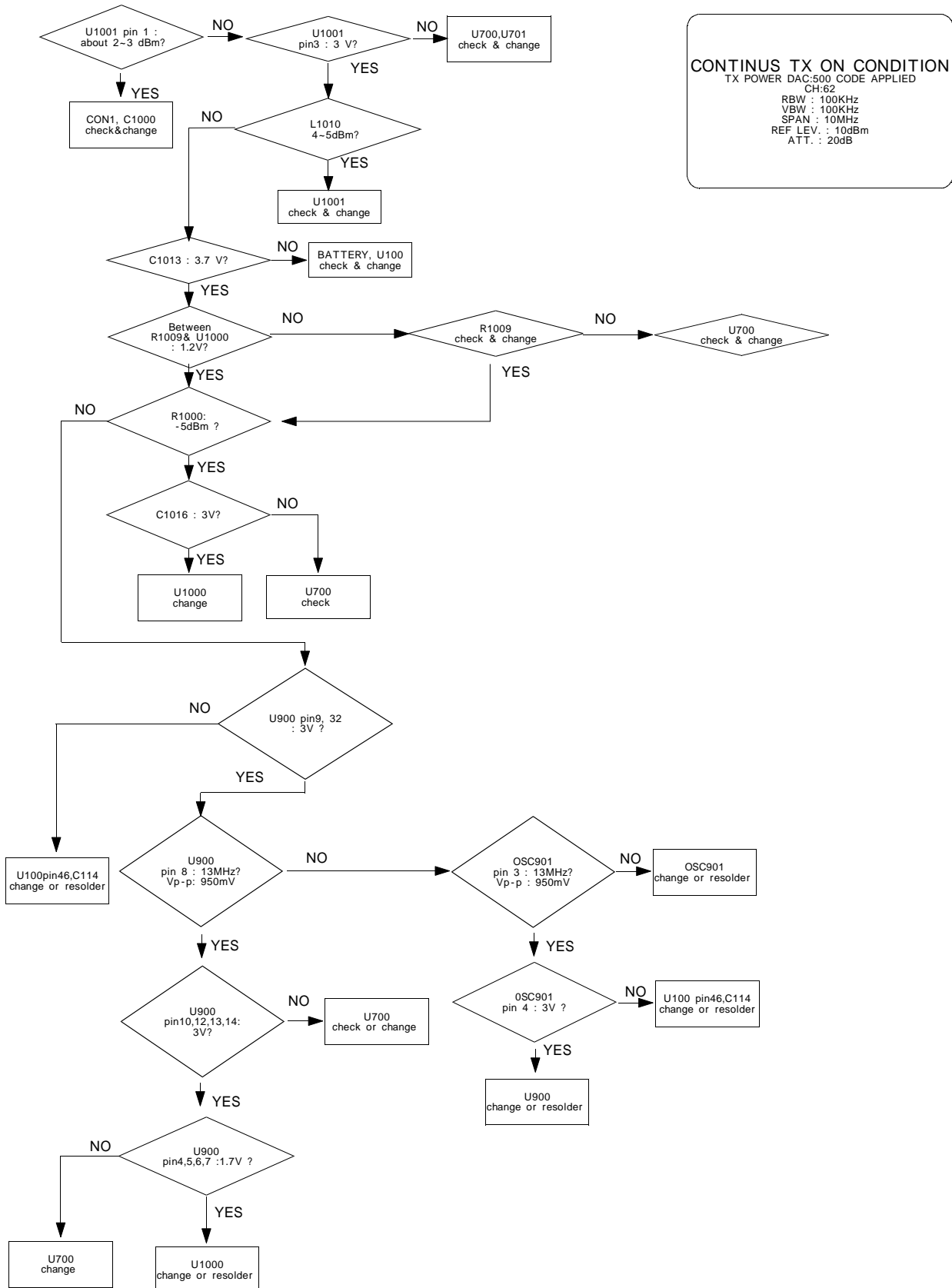




## 8. EGSM Receiver



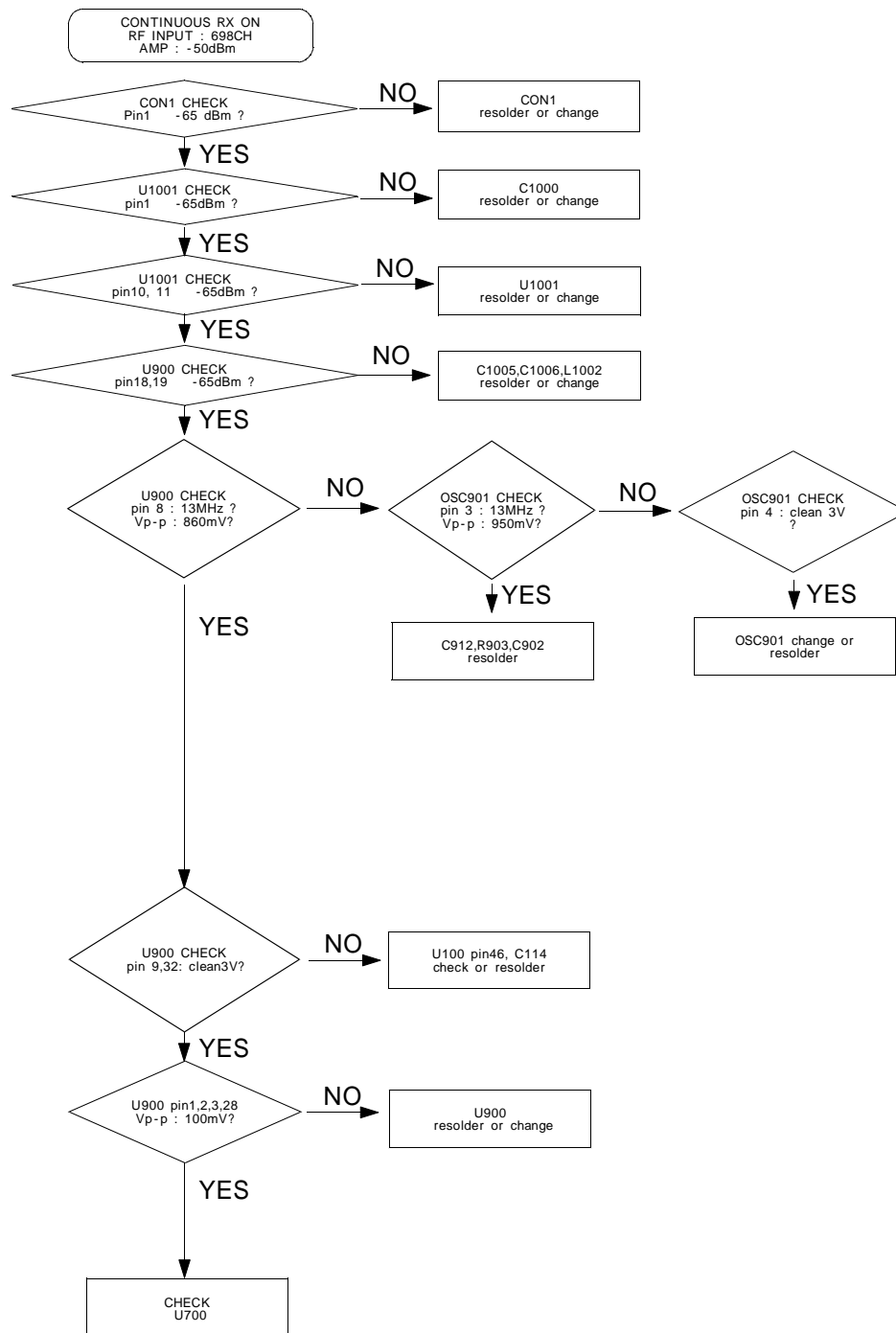
## 9. EGSM transmitter



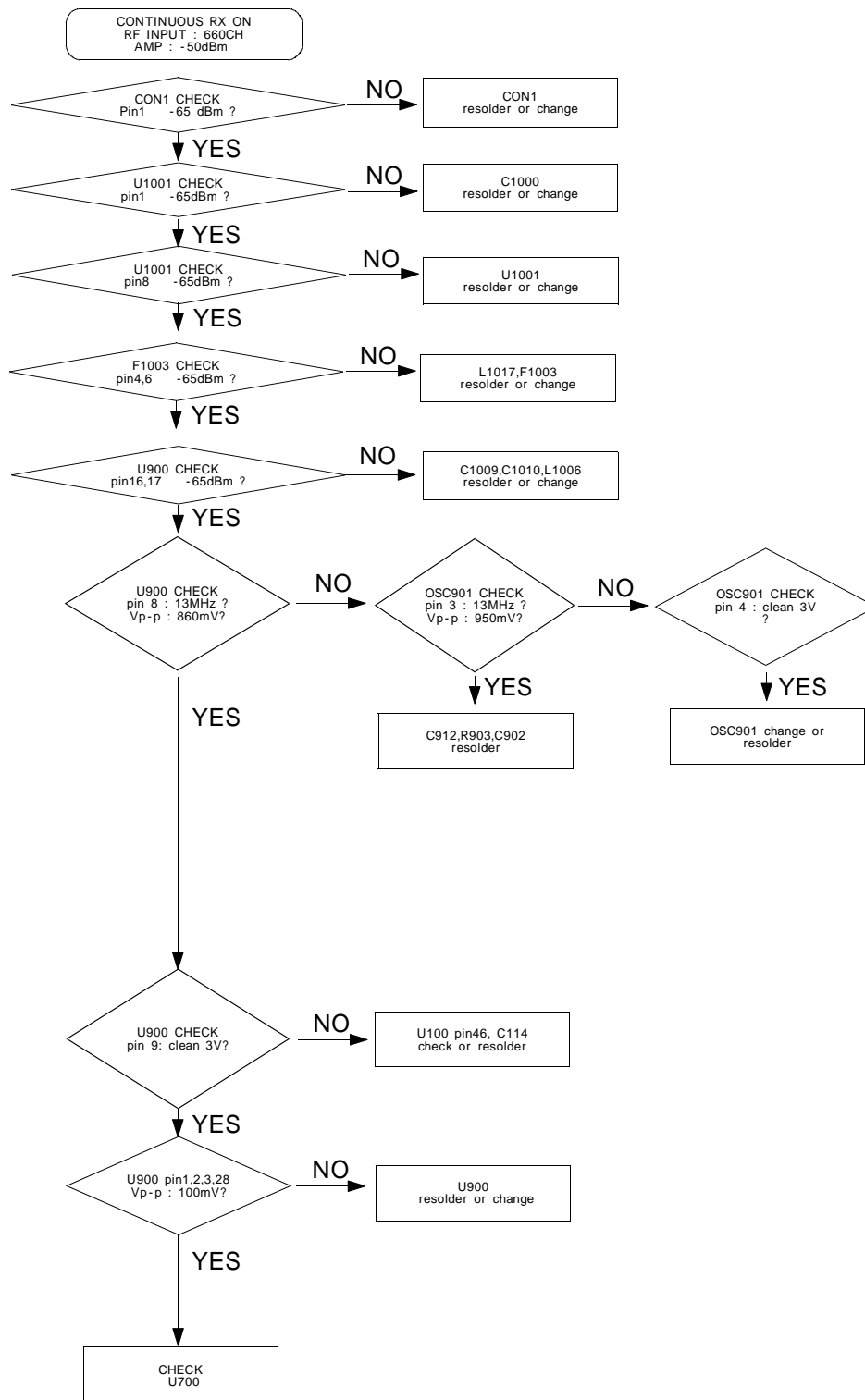
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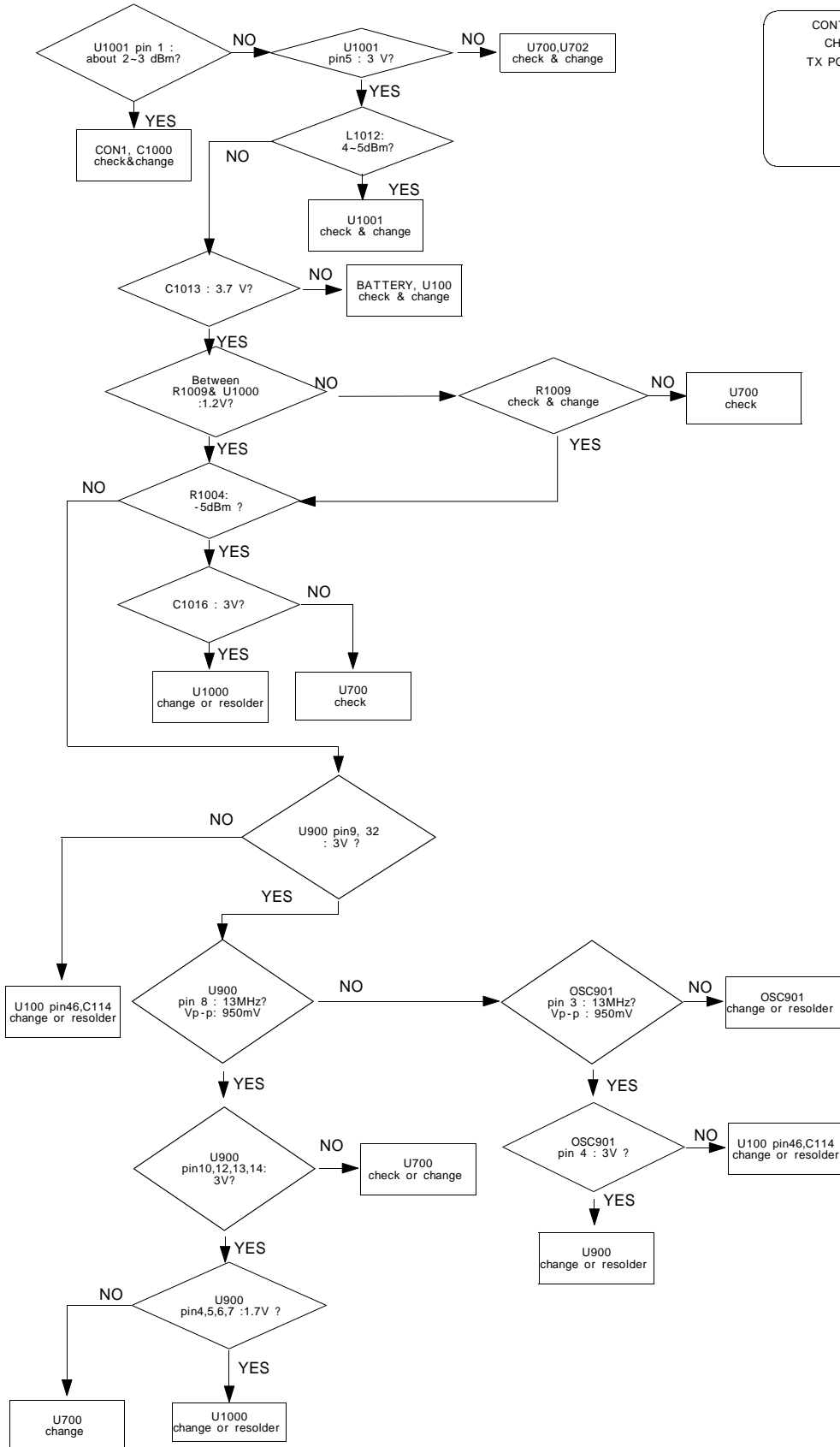
## 10. DCS Receiver



## 11. PCS Receiver



## 12. DCS/PCS transmitter



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